

**Claims**

1. A process for cooling and atomizing liquid or pasty substance or mixture of substances, in which a liquid or pasty substance / mixture of substances is combined with gaseous carbon dioxide and the mixture of liquid or pasty substance / mixture of substances and gaseous carbon dioxide is then expanded and cooled by contacting a flux of liquid carbon dioxide, as a result the substance / mixture of substances is cooled and atomized.
2. The process according to claim 1, in which the liquid carbon dioxide has a pressure of from 6 to 72 bar and a temperature of 216 to 304 K.
3. The process according to claim 1, in which the liquid carbon dioxide has a pressure of from 30 to 70 bar and a temperature of from 230 to 304 K.
4. The process according to claim 1, in which the gaseous carbon dioxide has a pressure of from 50 to 68 bar and a temperature of from 291 to 301 K.
5. The process according to claim 3, in which the gaseous carbon dioxide in the storage vessel has a pressure of from 1 to 10 bar and a temperature of from 273 to 304 K.
6. The process according to one of the claims 1 to 5, in which the liquid or pasty substance/ mixture of substances and/or the mixture of liquid or pasty substance/ mixture of substances and gaseous carbon dioxide is or are fed to at least one heatable or coolable line.
7. The process according to claim 1, in which the final average particle size is comprised in a range between 2 and 100  $\mu\text{m}$ .
8. The process according to claim 7, in which the final average particle size is comprised in a range between 40 to 80  $\mu\text{m}$ .
9. The process according to claim 8, in which the final average particle size is comprised in a range between 5 and 15  $\mu\text{m}$ .

10. The process according to one of claims 1 to 9, in which the liquid or pasty substance/ mixture of substances is mixed with the gaseous carbon dioxide in the storage vessel by means of a stirrer disposed in such vessel.
11. An apparatus for cooling liquid or pasty substance or mixture of substances which comprises:
- 5 (a) a storage vessel for the liquid or pasty substance/ mixture of substances, to which is allocated a line, in which a device for transporting the liquid or pasty substance/ mixture of substances is disposed,
- 10 (b) a source of liquid carbon dioxide, to which source is allocated a line,
- (c) a source of gaseous carbon dioxide, to which source is allocated a line which line has a connection with the line transporting the liquid or pasty substance/ mixture of substances,
- 15 (d) an expansion chamber in which the liquid carbon dioxide and the liquid or pasty substance/ mixture of substances mixed with the gaseous carbon dioxide are conveyed.
12. The apparatus according to claim 11, in which an apparatus for heating or cooling the line is disposed in the line allocated to the source of gaseous carbon dioxide.
- 20 13. The apparatus according to claim 11 to 12, wherein the source of gaseous and liquid carbon dioxide is contained in a thermostated cabinet.
14. The apparatus according to one of claims 11 to 13, in which an apparatus for heating or cooling the line is allocated to the line allocated to the storage vessel for the liquid or pasty substance/ mixture of substances.
- 25 15. The apparatus according to one of claims 11 to 14, in which an apparatus for mixing is allocated to the storage vessel for the liquid or pasty substance/ mixture of substances.

16. The apparatus according to one of claims 11 to 15, in which the expansion apparatus has two nozzles and two valves.
17. The apparatus according to one of claims 11 to 16, in which the nozzles and the valves have an isolating coating.
- 5 18. The apparatus according to one of claims 11 to 17, in which the nozzle is a capillary flow nozzle or a spraying (nebulizing) nozzle.
19. The apparatus according to one of claims 17 to 18, in which the valve is an open/closed valve or a control valve.
20. The use of the process according to claim 1 or of the apparatus according to  
10 claim 11 for pulverizing, pelleting, granulating and crystallizing.
21. The use of the process according to claim 1 or of the apparatus according to claim 11 for the production of microparticles for pharmaceutical uses.
22. The use of the process according to claim 1 or of the apparatus according to claim 11, wherein the microparticles contain one or more therapeutic active  
15 substances.